SUBFOSSIL BONES OF A LARGE SKINK (REPTILIA: LACERTILIA) FROM MOTUTAPU ISLAND, NEW ZEALAND

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Abstract. Subfossil lizard bones from Motutapu Island (Auckland) are illustrated and discussed. They came from beneath the Rangitoto ash layer and are therefore at least 600 years old. The bones are from a skink *ca.* 155 mm from snout to vent, which is larger than reported for any living New Zealand specimen.

Several writers have briefly mentioned the occurence in New Zealand of subfossil lizard bones (for example Yaldwyn 1958, Bull & Whitaker 1975: 246, Millener & Templer 1981 and Newman 1982: 142, 395) but few finds have been described or discussed in detail. This paper illustrates some bones of a skink recently collected on Motutapu Island near Auckland and reviews some of the gross osteological differences between the New Zealand skinks (*Leiolopisma, Cyclodina*) and geckos (*Hoplodactylus, Naultinus*).

In 1982, excavations at the "Sunde" archaeological site (N38/24; West Point, Motutapu Island) directed by R.K. Nichol uncovered bones of three large, at least five medium-sized and several small lizards. This paper discusses only a well preserved group of the larger bones (Auckland Museum H880) collected together in excavation unit Ebl and almost certainly belonging to one individual. The group comprises left and right maxillae, dentaries, scapulocoracoids and humeri, the fused parietals, the fused occipital elements, the right pterygoid and nine presacral vertebrae. The evidence for the other lizards rests on a small assortment of bones, some broken, which are not discussed further.

The "Sunde" site is of a seasonal Polynesian encampment which was occupied before and after the Rangitoto eruption of *ca.* A.D. 1400. The lizard bones were recovered from midden deposits beneath the Rangitoto ash and are therefore at least 600 years old, and probably not much older (R.K. Nichol pers. comm.). Bones of the tuatara (*Sphenodon punctatus)* and of many species of birds occur in the same strata (Scott 1970). The camp is believed to be one to which shellfish, fish and birds collected in the immediate vicinity were brought for processing and export, with some local consumption. The larger lizards also may have been caught on the island for consumption. However, it is equally possible that they may have lived or foraged in the midden and died there without having been eaten — the most likely explanation for the presence of the smaller animals.

The Auckland Museum registration numbers of the bones illustrated in this paper are as follows: subfossil (H880), *Leiolopisma suteri* (H675), *Cyclodina whitakeri* (H836), *Cyclodina oliveri* (H883), *Naultinus* (= *Heteropholis*) *stellatus* (H840) and *Hoplodactylus pacificus* (H676).

IDENTITY OF THE BONES

Apart from the work of Stephenson & Stephenson (1956) on geckos, the osteology of New Zealand lizards is virtually unstudied. In particular it is not known how the genus *Cyclodina,* resurrected by Hardy (1977), differs osteologically from the other New Zealand skinks (*Leiolopisma*). It was not the aim of the present study to compare in detail the genera and species of New Zealand skinks, but to illustrate a selection of the bones from Motutapu in order to demonstrate that they are from a skink and not a gecko. Cursory examination of some 20 sets of bones of New Zealand lizards in the Auckland Museum collection suggests that, as far as the gross morphology of the following elements is concerned, the differences between geckos and skinks outlined here apply to all the New Zealand genera.

Maxillae

The maxilla of geckos (Fig. 1) has a deep anterior notch and a single posterior process, whereas in skinks (Fig. 2) there is no deep notch and there are two posterior processes. On these grounds the subfossil maxillae (Fig. 3) are clearly those of a skink.

Dentaries

The dentaries of a gecko viewed from above (Fig. 4) are more curved than those of a skink (Fig. 5). The subfossil dentaries lack a strong curve, and in the lateral plane they widen greatly at the proximal end (Fig. 6). Gecko dentaries widen much less proximally.

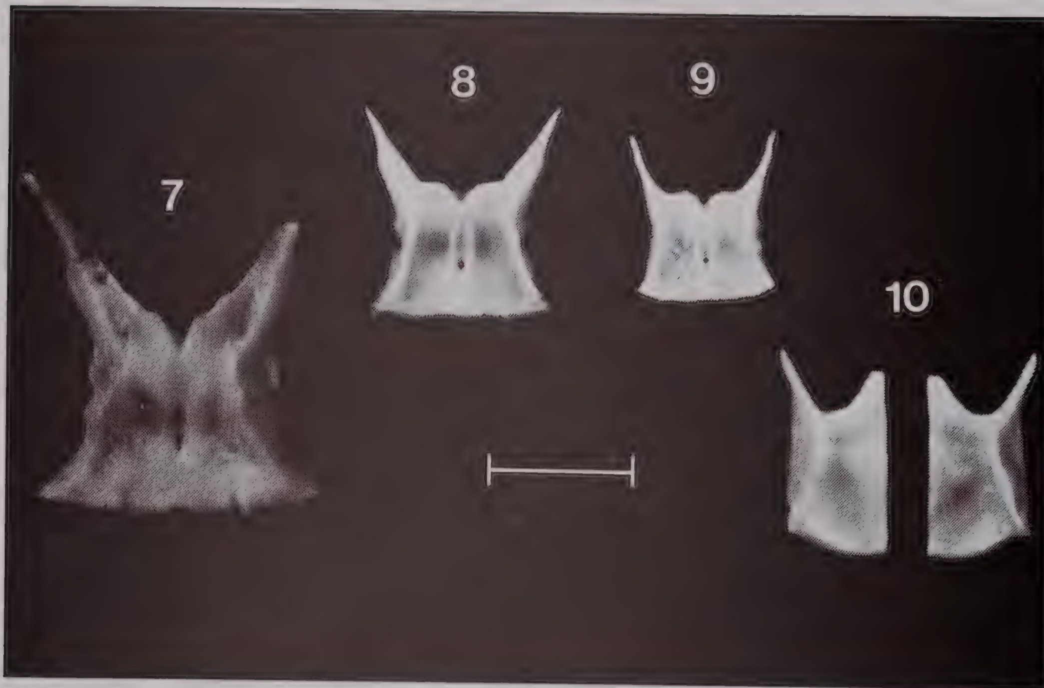
Parietals

The parietals of the subfossil (Fig. 7) and other skinks (Figs. 8, 9) are fused and pierced by a parietal (= pineal) foramen. This is the condition in lygosomine skinks according to Greer (1970), whereas in geckos (Stephenson & Stephenson 1956), the parietals remain separate and there is no foramen (Fig. 10).

Occipital Elements

On the fused occipital elements ("brain cases") of skinks (Figs. 11, 12) and the subfossil (Fig. 13) the pair of club-shaped anterior processes of the basisphenoid bone form an acute angle. In geckos (Fig. 14), the angle is obtuse and the brain case in many other ways looks unlike those of the skinks. The occipital elements are said to be not fused at all in *Naultinus* (Stephenson & Stephenson 1956).

Figs. 1-6. 1-3. Right maxillae (internal surfaces, anterior to left). 1. *Hoplodactylus pacificus*. 2. *Cyclodina oliveri*. 3. Subfossil. 4-5. Lower jaws (view from above). 4. *Naultinus stellatus*. 5. *C. whitakeri*. 6. Subfossil, left dentary (internal surface). Scale line = 5 mm.



Figs. 7-10. Parietals (internal surfaces, anterior to bottom). 7. Subfossil. 8. *Cyclodina whitakeri*. 9. *Leiolopisma suteri*. 10. *Hoplodactylus pacificus*. Scale line = 5 mm.

Scapulocoracoids

The scapulocoracoids ("shoulder girdle" elements) of the subfossil (Fig. 15) are similar to those of skinks (Figs. 16, 17). In geckos, the angles are different and there is an extra process (Fig. 18).

Vertebrae

The presacral vertebrae of the subfossil (Figs. 19-21) are procoelous (the centrum is concave in front and convex behind) and have solid centra. Most reptiles have procoelous vertebrae (Young 1950), but the vertebrae of New Zealand geckos (Stephenson & Stephenson 1956) are amphicoelous (the centrum is concave at both ends). Also, the centrum in geckos is pierced by a large central foramen not present in the New Zealand skink material I have examined.

SIZE

I measured alizarin transparencies of nine contemporary skinks (1 *Leiolopisma suteri*, 6 *L. smithi* and 2 *Cyclodina ornata*) with snout-vent (SV) lengths of 56-74 mm. The average ratio of right humerus length divided by SV length was 0.101 (range = 0.0897-0.112, standard deviation = 0.0065). The right humerus of the subfossil is 15.7 mm long, so by simple proportion the SV length of this animal must have been *ca.* 155 mm (140-175 mm using the range of ratios for the contemporary specimens).

Figs. 11-18. 11-14. Occipital elements (external surfaces, anterior to bottom). 11. *Cyclodina whitakeri.* 12. *Leiolopisma suteri.* 13. Subfossil. 14. *Hoplodactylus pacificus.* 15-18. Right scapulocoracoids (external surfaces, anterior to right). 15. Subfossil. 16. *C. whitakeri.* 17. *L. suteri.* 18. *H. pacificus.* Scale line = 5 mm.

Figs. 19-21. Subfossil. Three presacral vertebrae. 19. Posterior surface. 20. Anterior surface. 21. Lateral surface, anterior to left. Scale line = 5 mm.

Discussion

The largest skink occurring on Motutapu I today is *Leiolopisma suteri* which rarely exceeds 85 mm SV on the island (Towns 1975). However, the large skinks currently restricted to predator-free offshore islands are generally believed to have relict distributions and could once have occurred naturally on Motutapu. The subfossil skink may prove to be conspecific with any of the larger extant New Zealand species.

The three biggest contemporary New Zealand skinks are *Leiolopisma homalonotum* which reaches 143 mm SV (J.A. West pers. comm.) and is endemic to Great Barrier I, *L. fallai* which reaches 140 mm SV (Hardy 1977) and is endemic to the Three Kings Is, and *Cyclodina alani* which reaches 142 mm SV (I.C. Southey pers. comm.) and is known from only a few northern offshore islands. The subfossil skink at 140-175 mm SV, is therefore larger than any contemporary New Zealand specimen, or at least as large as the biggest on record. However, it is possible that some of our existing species produced larger individuals, than are seen today, when they existed in larger populations over wider areas.

Though large by New Zealand standards the subfossil skink is much smaller than many representatives of the family overseas. Even within *Leiolopisma* the largest living species (*L. telfairii,* extant on Round Island off Mauritius and extinct on Mauritius and Réunion) reaches at least 171 mm SV, and a species known from subfossils from Mauritius (*L. mauritiana*) probably reached 340 mm SV (Arnold 1980).

Although kiore (*Rattus exulans*) have occurred in New Zealand for at least 900 years (Gibb & Flux 1973) some inshore islands (such as Mana I near Wellington) escaped colonisation (Atkinson 1978). No kiore bones have been found at the "Sunde" site in the deposits beneath the Rangitoto ash (R.K. Nichol pers. comm.) so Motutapu I may have been free of kiore 600 years ago, which may help to explain the presence of such a large lizard.

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REFERENCES

ARNOLD, E. N.
1980 Recently extinct reptile populations from Mauritius and Réunion, Indian Ocean. *J. Zool., London* 191:33-47.

ATKINSON, I. A. E.
1978 Evidence for effects of rodents on the vertebrate wildlife of New Zealand islands. *In* P.R. Dingwall, I.A.E. Atkinson and C. Hay (eds.). *The ecology and control of rodents in New Zealand nature reserves.* Dept. Lands Survey Info. Ser. No.4. 237p.

BULL, P. C., and A. H. WHITAKER
1975 The amphibians, reptiles, birds and mammals. *In* G. Kuschel (ed.). *Biogeography and ecology in New Zealand.* The Hague, Junk. 689p.

GIBB, J. A., and J. E. C. FLUX
1973 Mammals. *In* G.R. Williams (ed.). *The natural history of New Zealand.* Wellington, Reed. 434p.

GREER, A. E.
1970 A subfamilial classification of scincid lizards. *Bull. Mus. Comp. Zool.* 139:151-183.

HARDY, G. S.
1977 The New Zealand Scincidae (Reptilia: Lacertilia); a taxonomic and zoogeographic study. *N.Z.J. Zool.* 4:221-325.

MILLENER, P. R., and C. J. TEMPLER
1981 The subfossil deposits of Paryphanta (Mac's Quarry) Cave, Waitomo. *J. R.Soc. N.Z.* 11:157-166.

NEWMAN, D. G. (Ed.)
1982 New Zealand herpetology. *N.Z. Wildlife Serv. Occ. Publ.* No.2:1-495.

SCOTT, S. D.
1970 Excavations at the "Sunde Site", N38/24, Motutapu Island, New Zealand. *Rec. Auckland Inst. Mus.* 7:13-30.

STEPHENSON, N. G., and E. M. STEPHENSON
1956 The osteology of the New Zealand geckos and its bearing on their morphological status. *Trans. R.Soc. N.Z.* 84: 341-358.

TOWNS, D. R.
1975 Reproduction and growth of the black shore skink, *Leiolopisma suteri* (Lacertilia: Scincidae), in north-eastern New Zealand. *N.Z.J. Zool.* 2: 409-423.

YALDWYN, J. C.
1958 Notes on the environment and age of the sub-fossil deposits of the Martinborough caves. *Rec. Dominion Mus.* 3: 129-135.

YOUNG, J. Z.
1950 *The life of vertebrates.* London, Oxford University Press. 767p.